

BELLCOMM, INC.

1100 Seventeenth Street, N.W. Washington, D. C. 20036

SUBJECT: Launch-On-Time Versus Launch Window
Case 310**DATE:** March 1, 1968**FROM:** W. B. GevarterMEMORANDUM FOR FILE

This memorandum has been written to provide a background for helping to determine Saturn V launch strategy in terms of launch window size. The question of major interest is the relationship between launch window length and launch-on-time.

From the data of Reference 1, it was found that the only vehicles with sufficient variations in launch window to be significant were the Thor-Delta and Atlas-Agena vehicles, both launched from the Eastern Test Range. The launch data for these vehicles is summarized in Table I.

For these two vehicles, Figures 1 and 2 present, as a function of window width, the percent of the launch attempts that launched on time (L.O.T.), and the percent that either scrubbed or exceeded the launch window. Figure 3 gives the cumulative probability distribution of the launch point in relationship to the window length for the Thor-Delta.

From these curves, one may conclude that:

1. For small launch window lengths, the attempts tend to either launch-on-time or scrub.
2. As the launch window increases, a larger percentage of the launch attempts launch inside the window.
3. As the window length increases, the probability of launch increases, though this effect diminishes as the window lengths get larger.
4. The relationship between launch window length and launch-on-time is not definitive. However, for the vehicles considered here, this relationship appears to be relatively unaffected by launch window length for lengths greater than one hour.

Table II summarizes the launch success data for these two vehicles and the Geminis and Saturns I and IB, the data for the Geminis and Saturns being taken from Reference 2. Observe that, except for the Saturns (which had very large windows), the tendency was either to launch-on-time or scrub rather than to launch inside the window.

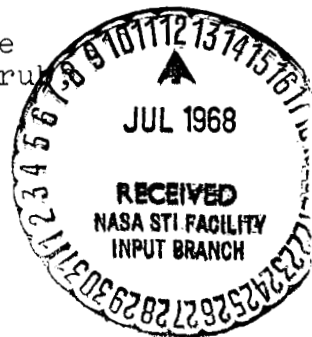
W. B. Gevarter
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Unclas
00/15 11167(NASA-CR-95469) LAUNCH-ON-TIME VERSUS
LAUNCH WINDOW (Bellcomm, Inc.) 8 P

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TABLE I
BASIC LAUNCH SUCCESS DATA OF NASA UNMANNED FLIGHTS AT E.T.R.
 (Extracted from Reference 1)

Thor-Delta Vehicles (5/60 to 12/66)

| Vehicle No. | *L.W. | Total Unscheduled** Hold Time/Attempt |
|-------------|-------|------------------------------------------|
| 1 | 45 | X,5 |
| 2 | 45 | X,X,22 |
| 3 | 60 | 0 |
| 4 | 180 | 0 |
| 5 | 45 | 0 |
| 6 | 70 | 11 |
| 7 | 47 | X,X,40 |
| 8 | 42 | X,5 |
| 9 | 275 | X,24 |
| 10 | 150 | 139 |
| 11 | 176 | 0 |
| 12 | 55 | 17 |
| 13 | 60 | 14 |
| 14 | 45 | 0 |
| 15 | 108 | 0 |
| 16 | 60 | 35 |
| 17 | 180 | 0 |
| 18 | 129 | 0 |
| 19 | 44 | 0 |
| 20 | 48 | X,0 |
| 21 | 45 | 0 |
| 22 | 45 | X,0 |
| 23 | 60 | 0 |
| 24 | 119 | 91 |
| 25 | 50 | 30 |
| 26 | 45 | 0 |
| 27 | 30 | 11 |
| 28 | 30 | 0 |
| 29 | 88 | 0 |
| 31 | 45 | X,X,X,90 |
| 33 | 85 | X,0 |
| 34 | 45 | 29 |
| 35 | 6 | X,X,0 |
| 38 | 45 | X,X,2 |
| 39 | 2 | 23 |
| 40 | 6 | X,28 |
| 43 | 420 | 0 |

Atlas-Agena Vehicles (1/64 to 8/67)

| Vehicle No. | L.W. | Total Unscheduled Hold Time/Attempt |
|-------------|------|----------------------------------------|
| 8 | 156 | 63 |
| 9 | 176 | X,0 |
| 11 | 179 | 104 |
| 12 | 176 | X,0 |
| 13 | 156 | 38 |
| 14 | 164 | 51 |
| 15 | 60 | X,X,X,0 |
| 16 | 60 | 0 |
| 17 | 91 | X,0 |
| 18 | 138 | 0 |
| 19 | 60 | 0 |
| 20 | 55 | 0 |
| 21 | 120 | 39 |
| 22 | 105 | 0 |
| 23 | 77 | 14 |
| 24 | 231 | 199 |

* All times in minutes

**X = Scrub

Note: Only vehicles for which sufficient data was available are shown.

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Table II

Launch Attempt Success

| Vehicle | L.O.T. | Scrubbed or Exceeded Window | Launched Inside Window |
|---------------|--------|--------------------------------|---------------------------|
| Thor-Delta | 34% | 38% | 28% |
| Atlas-Agena | 41% | 27% | 32% |
| Gemini | 43% | 25% | 22% |
| Saturn I & IB | 13% | 13% | 74% |

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References

- Reference 1. Eley, C. H. III, NASA Unmanned Program Data (5/13/60 to 8/1/67), Bellcomm Working Papers, September 14, 1967.
- Reference 2. Gevarter, W. B., "Countdown Hold Statistics", Bellcomm TM 68-2014-1, January 8, 1968.

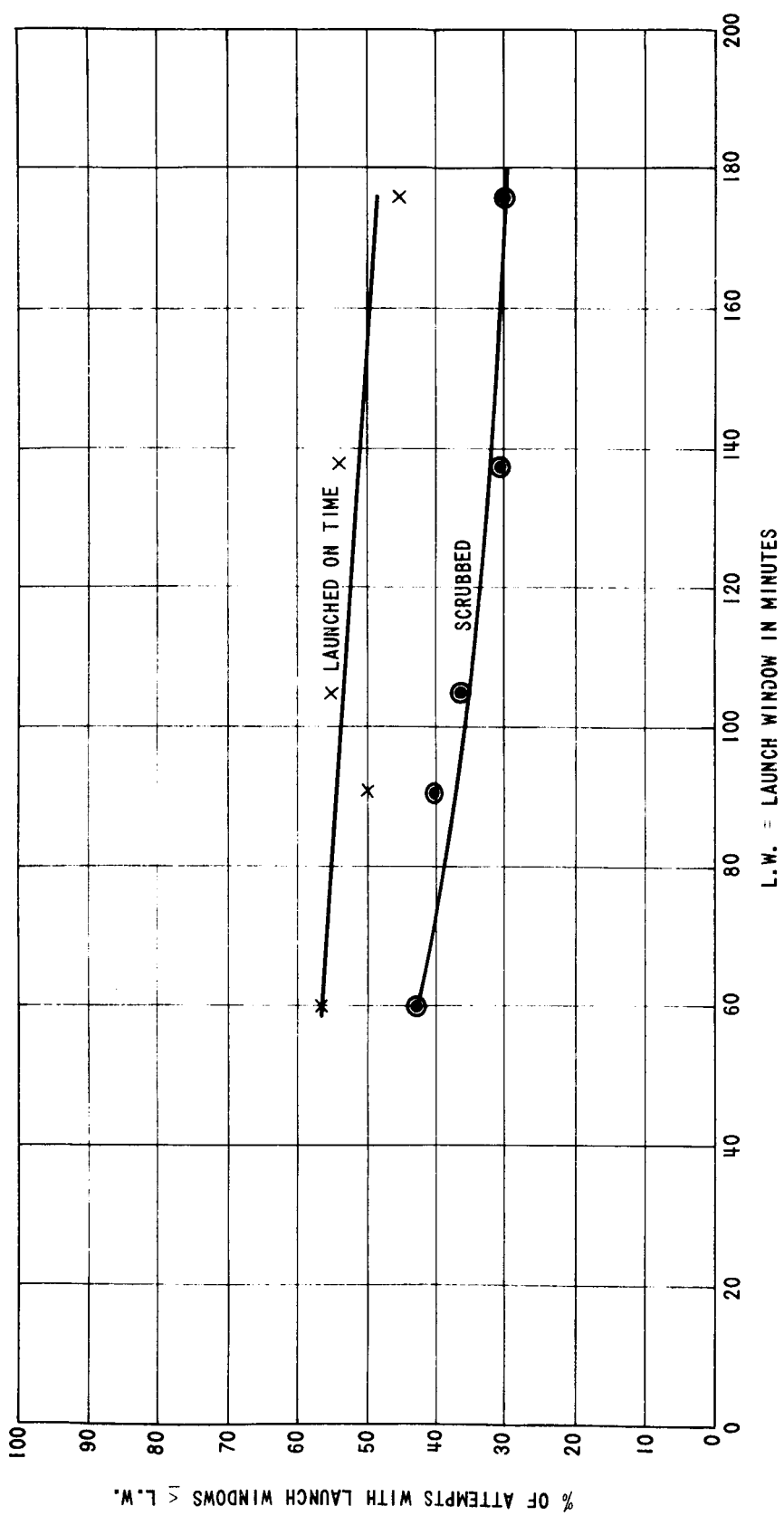


FIGURE 1 - LAUNCH ATTEMPT SUCCESS
ATLAS-AGENA

E.T.R., VEHICLES 8-24 (EXCEPT 10)

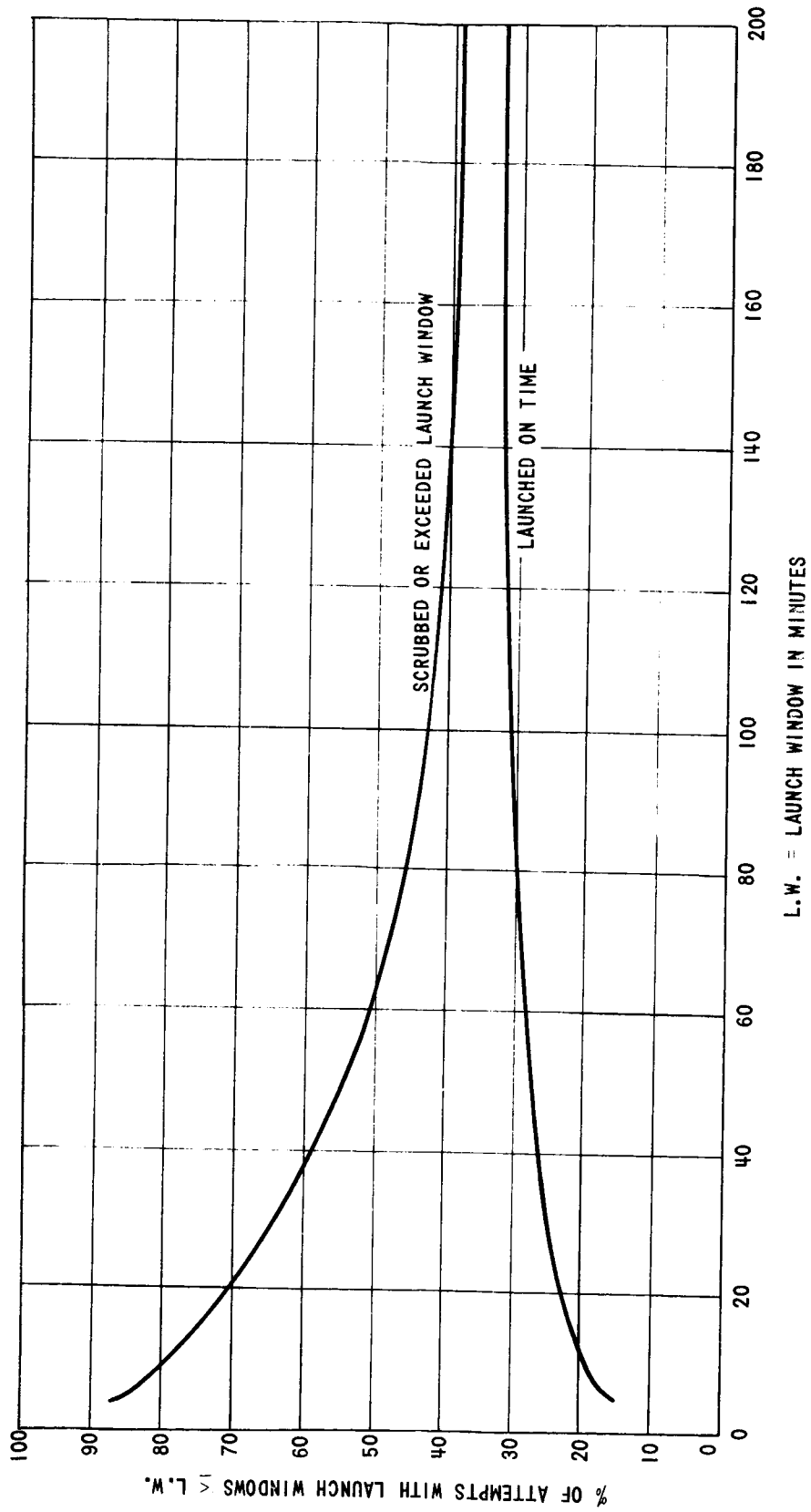


FIGURE 2 - LAUNCH SUCCESS OF THOR-DELTAS VEHICLES I-43
(EXCEPT NOS. 30, 32, 36, 37, 41, 42 FOR WHICH DATA
IS INCOMPLETE)

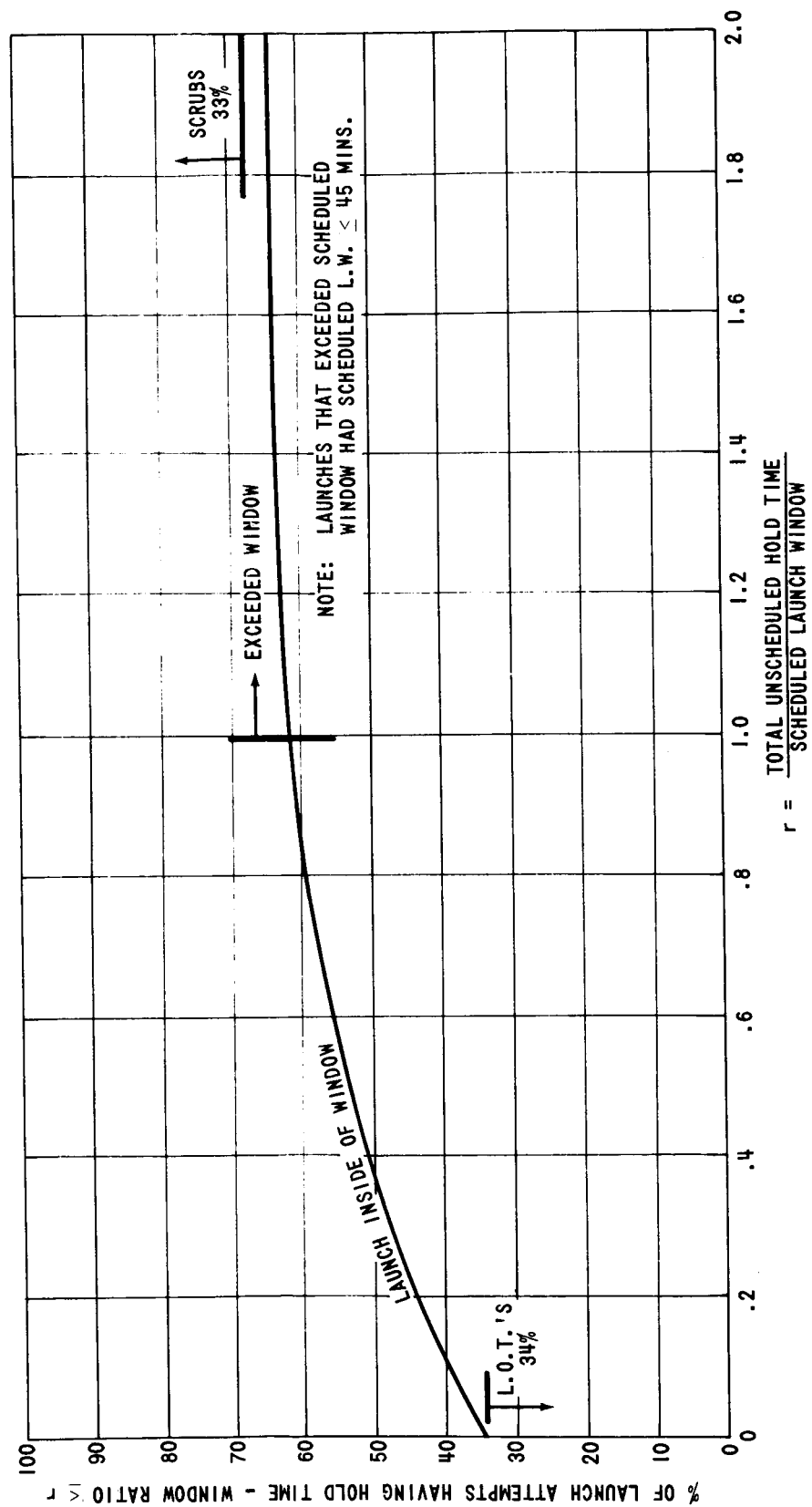


FIGURE 3 - TOTAL UNSCHEDULED HOLD TIME - LAUNCH WINDOW RATIO
THOR-DELTA5

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